[0040] The maximum depth may denote a coding unit having the smallest size that may be included in a maximum coding unit, that is, a minimum coding unit. In other words, the maximum coding unit may be divided into sub coding units having different sizes according to different depths, as will be described later with reference to FIGS. **8**A and **8**B. Also, the sub coding units having different sizes, which are included in the maximum coding unit, may be predicted or transformed based on processing units having different sizes. The transform is performed to transform pixel values of a spatial domain to coefficients of a frequency domain and may be discrete cosine transform or Karhunen Loever transform (KLT). In other words, the apparatus **100** for encoding an image may perform a plurality of processing operations for image encoding based on processing units having various sizes and various shapes. To encode image data, processing operations such as at least one of prediction, transform, and entropy encoding are performed, wherein processing units having the same size or different sizes may be used for every operation.

[0041] For example, the apparatus **100** for encoding an image may select a processing unit that is different from a coding unit to predict the coding unit.

[0042] When the size of a coding unit is 2N×2N (where N is a positive integer), processing units for prediction may be 2N×2N, 2N×N, N×2N, and N×N. In other words, motion prediction may be performed based on a processing unit having a shape whereby at least one of height and width of a coding unit is equally divided by two. Hereinafter, a processing unit, which is the base of prediction, is defined as a 'prediction unit'.

[0043] A prediction mode may be at least one of an intra mode, an inter mode, and a skip mode, and a specific prediction mode may be performed for only a prediction unit having a specific size or shape. For example, the intra mode may be performed for only prediction units having the sizes of 2N×2N and N×N of which the shape is a square. Further, the skip mode may be performed for only a prediction unit having the size of 2N×2N. If a plurality of prediction units exist in a coding unit, the prediction mode with the least encoding errors may be selected after performing prediction for every prediction unit.

[0044] Alternatively, the apparatus **100** for encoding an image may perform transform on image data based on a processing unit having a different size from a coding unit. For the transform in the coding unit, the transform may be performed based on a processing unit having a size equal to or smaller than that of the coding unit. Hereinafter, a processing unit, which is the base of transform, is defined as a 'transform unit'.

[0045] The encoding depth determiner **120** may determine sub coding units included in a maximum coding unit using RD optimization based on a Lagrangian multiplier. In other words, the encoding depth determiner **120** may determine which shape a plurality of sub coding units divided from the maximum coding unit have, wherein the plurality of sub coding units have different sizes according to their depths. The image data encoder **130** outputs a bitstream by encoding the maximum coding unit based on the division shapes determined by the encoding depth determiner **120**.

[0046] The encoding information encoder **140** encodes information about an encoding mode of the maximum coding unit determined by the encoding depth determiner **120**. In other words, the encoding information encoder **140** outputs a bitstream by encoding information about a division shape of the maximum coding unit, information about the maximum depth, and information about an encoding mode of a sub coding unit for each depth. The information about the encoding mode of the sub coding unit may include information about a prediction unit of the sub coding unit, information about a prediction mode for each prediction unit, and information about a transform unit of the sub coding unit.

[0047] The information about the division shape of the maximum coding unit may be information indicating whether each coding unit is divided. For example, when the maximum coding unit is divided and encoded, information indicating whether the maximum coding unit is divided is encoded. Also, when a sub coding unit divided from the maximum coding unit is divided and encoded, information indicating whether the sub coding unit is divided is encoded. The information indicating whether the sub coding unit is divided may be flag information.

[0048] Since sub coding units having different sizes exist for each maximum coding unit and information about an encoding mode must be determined for each sub coding unit, information about at least one encoding mode may be determined for one maximum coding unit.

[0049] The apparatus **100** for encoding an image may generate sub coding units by equally dividing both height and width of a maximum coding unit by two according to an increase of depth. That is, when the size of a coding unit of a kth depth is 2N×2N, the size of a coding unit of a (k+1)th depth is N×N.

[0050] Accordingly, the apparatus **100** for encoding an image may determine an optimal division shape for each maximum coding unit based on sizes of maximum coding units and a maximum depth in consideration of image characteristics. By variably adjusting the size of a maximum coding unit in consideration of image characteristics and encoding an image through division of a maximum coding unit into sub coding units of different depths, images having various resolutions may be more efficiently encoded.

[0051] FIG. **2** is a block diagram of an apparatus **200** for decoding an image, according to an exemplary embodiment.

[0052] Referring to FIG. **2**, the apparatus **200** for decoding an image includes an image data acquisition unit **210**, an encoding information extractor **220**, and an image data decoder **230**.

[0053] The image data acquisition unit **210** acquires image data according to maximum coding units by parsing a bitstream received by the apparatus **200** for decoding an image and outputs the image data to the image data decoder **230**. The image data acquisition unit **210** may extract information about a maximum coding unit of a current frame or slice from a header of the current frame or slice. In other words, the image data acquisition unit **210** divides the bitstream in the maximum coding unit so that the image data decoder **230** may decode the image data according to maximum coding units.

[0054] The encoding information extractor **220** extracts information about a maximum coding unit, a maximum depth, a division shape of the maximum coding unit, an encoding mode of sub coding units from the header of the current frame by parsing the bitstream received by the apparatus **200** for decoding an image. The information about a division shape and the information about an encoding mode are provided to the image data decoder **230**.